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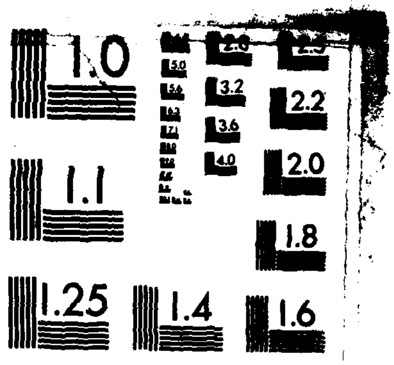

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Recruiter Incentives and Enlistment Supply

James N. Dertouzos

Rand

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In an empirical study of Army recruiting data, Rand concluded that demand factors such as recruiter quotas and incentives to achieve and exceed them play a critical role in the determination of enlistments. Recruiters who achieve high-quality quotas are less likely to be induced by existing incentives to increase their productivity than are those who do not achieve high-quality quotas. Thus, resource expenditures meant to induce an increase in potential supply may not result in actual high-quality enlistments because recruiters do not have incentives to secure them. Two major research and policy implications emerge: (1) Future attempts to project enlistments or to analyze the role of supply factors must consider demand factors explicitly; (2) the effectiveness of resource expenditures can be enhanced dramatically if appropriate incentives exist for recruiters.

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PREFACE

Effective manpower policies require information on the relative importance of factors affecting enlistments. Interest in estimating models that specify the relevant supply relationships has grown substantially over the past several years. Past studies are hampered, however, by a failure to consider the simultaneous role of demand factors, such as quotas, which can alter recruiter behavior and affect both the quantity and the quality of enlistments.

This report presents a modeling approach and an estimating methodology that explicitly consider quotas, incentives, and production tradeoffs between different categories of enlistments. The report is a product of Rand's Manpower Policy Research Center, sponsored by the Office of the Assistant Secretary of Defense (Manpower, Installations, and Logistics).

SUMMARY

The viability of the all-volunteer armed forces hinges on effective recruiting. Accordingly, there have been numerous studies of factors influencing the supply of enlistments, the goal being to enhance the accuracy of manpower projections and to promote the most productive use of recruiting resources. However, that research did not consider the effects of demand factors, such as the enlistment goals and incentives that are set up for recruiters to secure "high-quality" recruits (for example, high-school graduates scoring in the top half of the Armed Forces Qualification Test). Past studies therefore present only half the picture because recruiters can alter their output of enlistments by allocating their time in response to goals—and the incentive to meet and exceed these goals. This research seeks to complete the picture by developing and applying a modeling and estimation approach that simultaneously considers both demand and supply of enlistments.

In an empirical study of 1980 and 1981 Army recruiting data, we demonstrate that the traditional focus on the supply of high-quality recruits is severely flawed. Statistical results suggest that recruiters can substitute low- for high-quality enlistments at the rate of about four to one. Ignoring this tradeoff and the demand factors affecting recruiting choices can yield incorrect estimates of the effects of economic factors and resource expenditures. In particular, the estimated elasticities of high-quality enlistments with respect to variables such as the unemployment rate, civilian wages, and the number of recruiters are significantly higher if the potential tradeoff is considered.

In addition, the empirical results offer strong evidence that quotas can have dramatic effects on the level of recruiter effort. In 1980 and 1981, for example, Army recruiters had incentives to meet both high- and low-quality quotas. However, the econometric results suggest that once the quotas are met in such a situation, additional resources or a rise in the supply of enlistments does not necessarily increase the number of contracts. This is because recruiters have strong incentives to achieve quotas but may not be motivated to exceed them.

The methodology and empirical results have several policy and research applications. For example, models previously used for projecting military recruiting performance failed to predict the large rise in high-quality enlistments that occurred in 1982. That failure was largely due to the absence of adequate controls for the influence of demand factors, which had been systematically changing. Rough

calculations indicate that 36 percent of the rise in high-quality Army enlistments in 1982 can be accounted for by changes in quotas.

In addition, we computed new estimates of the marginal recruiting cost for high-quality enlistments. We found that this cost can vary significantly, depending on the existence of appropriate incentives. These cost estimates can be as much as 50 percent lower than suggested by past research. Until recently, most recruiters have had little difficulty in achieving quotas. Thus, experiments designed to measure the effects of a bonus and changes in advertising mix must consider the role of demand factors if they are to be successful. Otherwise, they may wrongly conclude that such changes would have little effect when they might be important policy alternatives under different economic circumstances.

Also, the supply estimates strongly suggest that current recruiter reward programs do not compensate recruiters adequately for the extra effort they have to expend to increase the number of high-quality enlistees. Under some circumstances, in fact, recruiters will be motivated to focus more on lower-quality categories.

ACKNOWLEDGMENTS

The author wishes to thank the many people whose comments and suggestions were invaluable during the course of this study and in the preparation of this report. In particular, the author owes a special debt to Rand colleagues Richard Fernandez, Glenn Gotz, James Hosek, John McCall, Michael Polich, and Peter Stan. In addition, the support and guidance of Dr. G. Thomas Sicilia, formerly Director, Accession Policy, OASD(MIL), and his successor, Dr. W. S. Sellman, were greatly appreciated. Extremely valuable assistance was provided by several members of the Accession Policy staff, including Lt. Col. Douglas Patterson, Capt. Louise Wilmot, Maj. James Hoskins, and Ronald G. Liveris. Finally, this work could not have been completed without the assistance of several able students, most notably Syam Sarma and Thomas Chesnutt.

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I. INTRODUCTION

n the years ahead, several factors could threaten the viability of the /olunteer armed forces. To begin with, recruiting may become more icult as a declining youth population decreases the pool of potential stments. Also, economic prosperity would probably render civilian ›loyment more attractive to youth than the military. Nonetheless, increasing sophistication of military hardware may require enlistees ›ver greater skill and intelligence. Finally, budget constraints may ke it harder to expend the resources required to attract the desired ntity and quality of enlistments.

n such a setting, policymakers have all the more need for informa- ı wherewith they can respond to demographic and economic changes h effective allocations of recruiting resources. Unfortunately, past earch has failed to come to any general agreement regarding the ıtive magnitudes or importance of factors affecting enlistment sup- .[1] This failure is largely due to a critical flaw in the methodology ployed in most manpower studies.[2] In particular, the observed pro- :tion of enlistments is assumed, at least implicitly, to be determined ely by supply factors. But recruiters do not passively process enlist- nts; rather, by allocating their time differently in response to quotas d to rewards for achieving and exceeding them, they alter both the antity and quality of enlistments. By affecting recruiter behavior, nand factors such as goals and incentives can play a critical role in : determination of enlistments. Unfortunately, most past research ıores the influence of demand.[3]

A modeling approach and estimation methodology are suggested here ıt begin to remedy the past deficiency. This research recognizes that :ruiters can choose to emphasize different categories of enlistments d can alter their overall intensity of effort. Such choices are

[1]Some of the more recent examples include Cralley (1979), Fernandez (1979), Huck l Allen (1977), Morey (1980), and Ash, Udis, and McNown (1983).

[2]Indeed, Sargent (1981) argues that most empirical studies are hampered by the ure to recognize that economic data are generated by the "choices of private agents eracting in markets assumed to be organized along well-specified lines." This recogni- ı "offers the analyst the ability to predict how agents' behavior and the random ıavior of market-determined variables will change when there are policy interventions t alter some of the agents' dynamic constraints."

[3]One notable exception is an econometric model of Navy enlistment behavior, Siegel l Borack (1981). However, despite the inclusion of variables representing demand, no empt is made to estimate a simultaneous equation model which is capable of sepa- ely estimating the relative importance of these factors.

ameters serve to generalize the expression and allow for a variety of ›ctives as special cases.[4]

Maximizing Eq. (9) subject to the supply relationship of Eq. (6) ds the following first-order condition:

$$[\theta(T - \gamma_t Q_t)]/[(1 - \theta)(H - \gamma_h Q_h)] + 1 = L/\lambda H \qquad (10)$$

It is possible, using nonlinear maximum likelihood estimation techues, to estimate Eqs. (6) and (10) jointly. If the model specification orrect, the system is exactly identified and the procedure yields conent estimates of the coefficients and asymptotically efficient stand errors. The advantage in using Eq. (10) is that the underlying ameters of recruiter objectives are identified as well as the structal supply relationships. (Unfortunately, the procedure is costly. me preliminary estimates using this approach are presented below.)

IPIRICAL ESTIMATES OF ENLISTMENT SUPPLY

Table 2 presents three sets of estimates for 1980 and 1981. The first o sets report ordinary least squares (OLS) coefficient estimates and ndard errors for Eq. (7), the reduced-form approximation for the mber of high-quality enlistments. The first set, however, excludes e quota variables that influence demand for enlistments. This specifition represents the most common research approach. The second includes the quota variables and can be interpreted as the reducedrm relationship between the number of high-quality enlistments and ctors that characterize both supply and demand. The last set reports sults from the joint maximum likelihood estimation of the supply lationship of Eq. (6) along with the reduced-form Eq. (8).

The comparison of reduced-form estimates for 1980 suggests that it n be important to include variables denoting enlistment demand. In rticular, the estimates indicate that the elasticity of high-quality listments with respect to high-quality quotas was .420 with a standrd error of .094. An increase in quotas for low-quality enlistments s an opposite but equivalent effect. In addition, the inclusion of ota variables changes the magnitude of other coefficients to some gree, though the qualitative nature of the results remains similar.[5]

[4]A variety of characterizations may seem to be equally plausible. The "Stone-Geary" mulation above has several desirable properties. Most important, the parameters can readily estimated and interpreted. Future research will investigate alternative proaches.

[5]In general, we would expect that excluding quotas would bias the coefficients of varioles that are correlated to the quotas. For example, large recruiting areas have higher otas and bigger staffs, and are typically located in communities with higher wage rates. is not surprising, therefore, that these coefficients were most affected. The correla-

herefore, it is necessary to introduce an expression that takes account ' recruiter objectives. As a first approximation, one can use specifica-ons representing the reduced-form expressions of Eqs. (4) and (5). ssume that the equations for high- and low-quality enlistments are:

$$\log(H) = \alpha_0 + \alpha_1\log(U) + \alpha_2\log(W) + \alpha_3\log(R) \quad (7)$$

$$+ \alpha_4\log(P) + \alpha_5\log(Q_h) + \alpha_6\log(Q_L)$$

ıd

$$\log(L) = \gamma_0 + \gamma_1\log(U) + \gamma_2\log(W) + \gamma_3\log(R) \quad (8)$$

$$+ \gamma_4\log(P) + \gamma_5\log(Q_h) + \gamma_6\log(Q_L)$$

he joint estimation of either Eq. (7) or Eq. (8) along with the struc-ıral Eq. (6) provides estimates of the underlying supply relationships f primary interest to this study.[3]

As an alternative, one can directly use an expression representing ecruiter objectives. To illustrate, assume that recruiters, or recruiting istricts, attempt to maximize some objective

$$U = \theta\log[(H/Q_h) - \gamma_h] + (1 - \theta)\log[(T/Q_t) - \gamma_t] \quad (9)$$

'here

T = number of enlistments, $H + L$,

Q_h = quota for high-quality enlistments,

Q_l = quota for low-quality enlistments, and

Q_t = the total volume quota, $Q_h + Q_l$.

'he shift parameters, γ_h and γ_t, can be given the interpretation of eing "subsistence" levels of performance relative to quotas. That is, ıeir value denotes the minimum acceptable percentage of the quotas ıat recruiters strive for. The weight parameter, θ, represents the rela-ve importance of high- versus low-quality enlistments in the objec-ves of recruiters. If θ is close to a value of 1, higher quality is mphasized as opposed to lower categories. It is clear that these

[3]This procedure is equivalent to a two-stage least squares estimation of Eq. (6) with ıe quotas acting as instrumental variables. We will see that the estimates obtained ere invariably similar to those derived using a more complex, nonlinear, full-formation, maximum likelihood method.

Table 1

VARIABLE DEFINITIONS AND MEAN VALUES

		Mean	
riable	Definition	1980	1981
H	Enlistees having high school diplomas; AFQT: 50+ percentile	39.6	46.9
L	Enlistees having high school diplomas; AFQT: 50- percentile	64.1	58.2
U	Unemployment rate, all workers 16 years of age or older	6.9	7.2
W	Wages for manufacturing production workers, all ages	7.1	7.8
P	Population (1980) of males, 15-19 years of age (thousands)	165.6	165.6
R	Recruiters	75.9	74.9
Q_h	Quota for high-quality enlistments	49.7	40.7
Q_L	Quota for low-quality enlistments	67.6	66.7

vhere H and L are enlistments, U is the unemployment rate, W is the ivilian opportunity wage rate, R is the number of production ecruiters, and P is an estimate of the 1980 census population for nales 15–19 years of age, and the M_i 's are monthly dummy variables neant to capture seasonal variations. (Only nine months of data for ach year were readily available.)

The tradeoff parameter, λ, represents the elasticity of high-quality vith respect to low-quality enlistments. If, as expected, low-quality nlistments are easier to attract, λ will have a value between 0 and −1. The β's can be interpreted as partial elasticities of high-quality recruits vith respect to unemployment, wages, and recruiters. They are "partial" because they are computed under the assumption that the number of low-quality recruits is held constant.

The supply relationship, Eq. (6), contains two endogenous variables, H and L, and cannot be estimated using single-equation methods.

III. EMPIRICAL RESULTS

We applied the simultaneous equation model of enlistment supply and demand to monthly data from the Army for both 1980 and 1981. This section first describes the variables employed and provides summary statistics. It then presents an empirical specification of the model and discusses two estimation strategies. Finally, the econometric estimates are provided and interpreted.

DATA DESCRIPTION

The units of observation were areas served by individual Military Entrance Processing Stations (MEPS), of which there were 67 during this time period. To limit model complexity, data were used only from the 33 MEPS that were not affected by a variety of experimental educational assistance test programs operating at the time. The data include observations on enlistment contracts, local employment conditions, area populations, civilian wage opportunities, production recruiters, and quotas.[1] Table 1 provides variable definitions and mean values for 1980 and 1981.

ESTIMATING EQUATIONS

The general expressions for enlistment supply and demand must be given specific functional forms for empirical implementation. As a first approximation, assume that the supply relationship has the following log-linear form:[2]

$$\log(H) = \lambda\log(L) + \beta_0 + \beta\log(U) + \beta_2\log(W) + \beta_3\log(R) + \beta_4\log(P) + \sum \beta_i M_i \quad (6)$$

[1]For a more detailed description of the data employed, see Fernandez (1982).

[2]The algebraic formulation employed for empirical purposes imposes a tradeoff curve which is convex to the origin. Although the implied increasing returns to specialization could make sense at interior points, this is not likely for all ranges of production, especially as enlistments asymptotically approach population limits. Thus, the relationship should be viewed as a local approximation that facilitates comparison with more traditional models of enlistment supply. Future work should use more flexible functional forms.

These equations express numbers of high- and low-quality enlistments as functions of all exogenous variables affecting both supply and demand. Unfortunately, without imposing further restrictions on the underlying relationships of Eqs. (1) and (2), the model yields few qualitative predictions.[12] Thus, detailed analysis must await an empirical implementation of the model.

[12]At this stage of generality, the signs of most of the partial derivatives of Eqs. (4) and (5) are ambiguous. All that can be said is that $\partial H / \partial Q$ is opposite in sign to $\partial L / \partial Q$. That is, a change in quotas will alter objectives, but will not disturb supply relationships. So, if recruiters opt for more high quality, it must be at the expense of low-quality enlistments. In view of the theory of conjugate pairs (Archibald, 1965), this is not surprising.

It takes time, however, to process even a "walk-in" recruit. A recruit of any quality requires paper work, counseling, and physical and mental testing before induction. Thus, an increase in the number of low-quality recruits will take time and resources away from activities that would increase high-quality enlistments. The appropriate model is:

$$f(H, L, X, R) = 0 \tag{1}$$

The tradeoff between high- and low-quality enlistments, dH/dL, is assumed to be zero in other models. If the tradeoff is actually negative, the assumption imparts a bias in the estimation of the supply relationships.[10]

It is not possible to estimate Eq. (1) directly without some explicit modeling of enlistment demand or recruiter objectives. Assume that the general form of recruiter objective is given as:

$$U = g(H, L, Q) \tag{2}$$

where Q is a vector of quotas or enlistment goals, by category. The recruiter or recruiting area will maximize the objective (2) subject to the supply constraint (1). This process yields first-order conditions for a maximum:[11]

$$g_H / g_L = f_H / f_L \tag{3}$$

The first-order condition, along with the supply relationship of Eq. (1) may be combined to derive reduced-form expressions that reflect the interaction of both supply and demand for enlistments:

$$H = \varphi_1(X, R, Q) \tag{4}$$

and

$$L = \varphi_2(X, R, Q) \tag{5}$$

---

[10]For example, if the true model is $H = \beta X + \lambda L + u$, where u is a normally distributed error term, an OLS regression that assumes λ to be zero yields biased estimates for β if X is correlated with L. Of course, simple OLS estimation of an expression that includes low-quality recruits would yield traditional simultaneous equation biases. Thus, specification of the demand side of the process is required.

[11]In other words, the marginal rate of substitution of high-quality for low-quality enlistments in the recruiter's objective function equals the potential tradeoff given by the slope of the supply relationship. The second-order condition concerns the relative rates at which the recruiters' indifference curve and the enlistment supply curves are changing. For example, if recruiters are out to maximize award points, they will choose H and L such that the the marginal rate of substitution will be equal to the ratio of points awarded.

gle high-quality one, thereby earning 20 additional points while giving up only 16. On the margin, the recruiter thus has an incentive to emphasize the low category. For recruiters meeting quotas, the impact of an exogenous shift in supply may not induce a rise in high quality.[7]

Once quotas are achieved, the solution may be further complicated if recruiters do not have sufficient incentives to use resources fully and overproduce. Indeed, if future quotas are raised to current production levels, recruiters may conclude that it is in their best interest not to exceed quotas significantly.[8] If they did, present success could guarantee future failure, especially if the recruiting environment deteriorates. Also, if recruiters see only meager rewards for overproduction, they may choose to enlist fewer people.[9]

Thus, recruiter quotas and incentives to achieve and exceed them can have dramatic effects on observed enlistment levels. The relationship can be complex, however, with varying implications for the identification of enlistment supply relationships. A more general model of enlistment demand is suggested below.

A SIMULTANEOUS EQUATION MODEL OF ENLISTMENT SUPPLY AND DEMAND

Most studies model the number of high-quality enlistments as a function of exogenous economic variables, X, and recruiting resources, R. The implicit assumption is that low-quality enlistments are costless because they are in excess supply and are therefore demand-limited. A general functional form representing this relationship would therefore be:

$$H = f(X, R)$$

[7]Of course, this result could be the same for recruiters who remain hopelessly below quotas. Rather large point bonuses are offered for achieving quotas. However, relative point awards for high and low categories are the same for underproduction. For example, the Army point awards for underproduction are half of those for overproduction, but still have an 8/5 ratio. If quotas are achieved, additional bonus points are awarded. So, there are incentives to attain quotas, if possible. If the tradeoff is lower than 5/8, however, point-maximizing behavior may dictate an emphasis on lower quality if quotas are out of reach. These points are illustrated, in greater detail, in Sec. IV.

[8]For example, it is commonly observed in the central planning literature that quota overfulfillment can increase future requirements. See Nove (1977).

[9]This possibility is confirmed by estimates reported in the Sec. III. Unfortunately, observed enlistments in such circumstances can no longer be assumed to be on the production tradeoff curve, thereby making statistical identification of enlistment supply relationships quite difficult. Future research efforts should attempt to include an explicit treatment of the labor-leisure substitution in this context.

conditions and available resources, both quotas cannot be met simultaneously. In other words, the point Q is outside the feasible range of choices. By assumption, the district will wish to allocate resources so as to maximize the number of high-quality recruits, subject to the constraint that the volume quota is achieved. Thus, the point chosen is A, representing 8 and 7 enlistments for the high- and low-quality categories, respectively.

Now, as before, imagine that exogenous supply factors impel a shift in the recruiting tradeoff curve to the dashed curve. Assuming that quotas do not simultaneously increase, the new point of production will be B, representing a large increase in high-quality enlistments. Of course, it would be a mistake to attribute that increase solely to supply factors; part of it is due to the decline in low-quality enlistments. That is, recruiters have reallocated their resources to produce more high-quality enlistments.

Over time, however, quotas are not held constant. If, for example, they were increased to total 20 at the same time that supply changes shifted the tradeoff curve outward, we might observe an equilibrium at a point like C. So, despite the supply increase, high-quality enlistments have been relatively stable while low-quality enlistments have increased. Clearly, an analysis of only the former, with no consideration of quotas and enlistment mix changes, could yield misleading results.[6]

Once quotas for both high- and low-quality enlistments are achieved, recruiters' incentives may change. If recruiters have incentives to maintain overall levels of enlistments while maximizing quality, the situation is no different from the underproduction equilibrium discussed previously. That is, since recruiters can now meet the total quota easily, they can concentrate on producing high-quality recruits. Thus, economic and resource factors will have large effects, partly because recruiters reallocate effort towards higher quality. If this reallocation is not considered, the importance of supply effects will be overstated. However, it is possible that recruiters may not wish to maximize quality but to maximize award points, which are determined by precise formulae. For example, the Army currently awards 16 points for each high-quality recruit over the quota, and 10 points for an additional low-quality recruit. Now assume that the tradeoff at the point of production (the slope of the tradeoff curve) is 1/2. That is, the recruiter can obtain two low-quality enlistments by giving up a sin-

[6]Interestingly, under these circumstances, an increase in the high-quality quota, because it increases the overall volume mission, shifts the 45-degree line outward and actually decreases high-quality enlistments!

the recruiter will then attempt to secure as many high-quality recruits as possible.[5]

This quota scheme and the resulting equilibrium are illustrated in Fig. 2. Assume that the area's quotas are 12 and 3 high- and low-quality recruits, respectively—represented at point Q. The 45-degree line connecting the axes and passing through Q represents all combinations of high- and low-quality recruits that sum to an overall volume mission of 15. However, the initial recruiting tradeoff curve (the solid line passing through point A) indicates that, given current economic

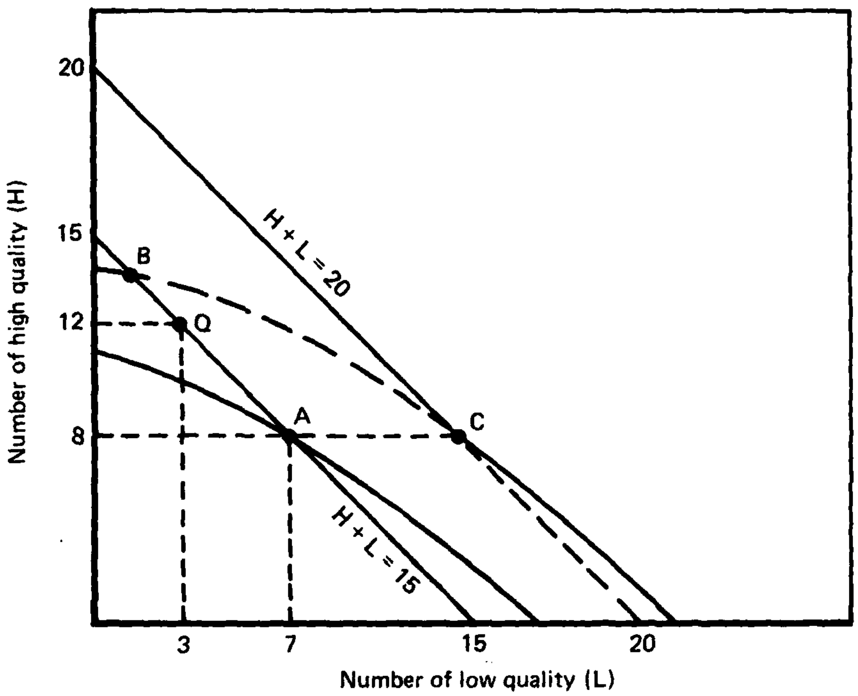

Fig. 2—Quotas and recruiting choices

[5]This characterization of behavior is somewhat restrictive and is imposed for the purpose of illustration. More general formalizations are suggested below. Of course, this specification makes little sense if high-quality enlistments are not more difficult to secure. Presumably, they are, and the assumed shape of the tradeoff curve reflects this as a maintained hypothesis. In the research to follow, however, this is treated as an empirical hypothesis which, in fact, is tested and confirmed.

point C is also possible, representing no rise in the number of high-quality enlistments even though supply has increased.

It is clear that identical shifts in supply due to economic and demographic factors or resource expenditures can result in a variety of outcomes which depend on recruiter choices. The traditional analysis, focusing only on a single category of enlistments, fails to identify the supply effects that are represented by the shift in the tradeoff curve. The ultimate change in the number of high-quality recruits also depends on which point is chosen. Obviously, attributing all changes in the number of high-quality enlistments to shifts in supply could lead to different answers, often incorrect, because they also depend on the allocation of recruiter time and effort.

RECRUITER QUOTAS AND ENLISTMENT DEMAND

Recruiters are evaluated by the quantity and quality of enlistees they attract. Given the range of feasible production, recruiter choices will depend on the rewards associated with different combinations of enlistments. These rewards can have a variety of characteristics.[3] In general, recruiters are given monthly quotas or goals. The performance of a recruiter (or a recruiting area commander) is measured by success or failure in meeting these quotas. In turn, promotion speed is likely to be influenced by performance. If so, recruiters have incentives to achieve these quotas and, to a lesser degree, to exceed them.[4]

A simple model of recruiter behavior can be constructed to illustrate the importance of quotas in the determination of actual enlistment choices. Imagine that a recruiting area is given a quota or "mission" for both total and for high-quality enlistments. Assume that the district will strive to attract a total number of high (H) and low (L) quality enlistments equal to some quota Q for total enlistments. That is, $H + L = Q$. Above all else, the recruiter will attempt to achieve this quota. Next, assume that, once this overall volume mission is attained,

---

[3]The reward systems have varied over time and across services. All services have overall enlistments goals, but they differ according to how these are broken down by category. Since 1981, the Army has established explicit goals by quality category. Navy quotas are broken down by different criteria but reward high-quality enlistments (via the Freeman plan) to a greater degree. The other services are less explicit in their systems but not-so-subtle pressures exist that encourage the recruiting of higher-quality individuals.

[4]The services reward overproduction, i.e., exceeding quotas, to some degree. For example, the Army awards badges, rings, and letters of commendation at different levels of achievement. However, we will see that these rewards may not be taken very seriously by all recruiters.

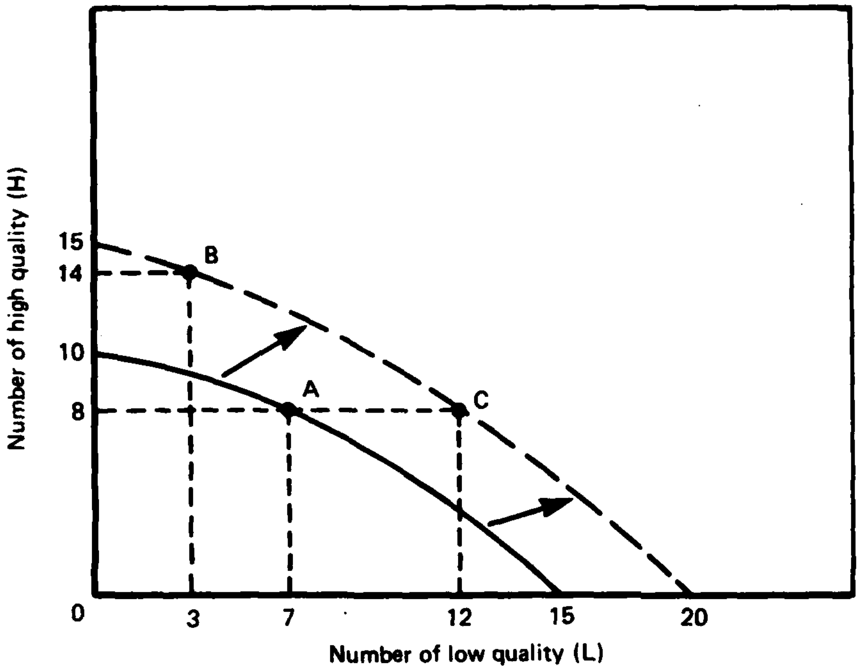

Fig. 1—Supply increases and recruiting possibilities

resources are fixed, the district must trade between the two categories of recruits.[2]

A changing environment or resource level causes the tradeoff curve to shift. For example, imagine that unemployment increases or that a program of enlistment bonuses improves the recruiting climate. The range of potential enlistments increases and the tradeoff curve shifts outward (becoming the dashed curve in Fig. 1). However, the resulting change in high- and low-quality enlistments depends not only on the size of the shift but also on the point chosen along the curve. That is, the district could choose a point such as B, representing a large increase in the number of high-quality recruits. On the other hand,

[2]This representation of the tradeoff curve and its ramifications for examining recruiter productivities was initially conceptualized in an unpublished paper by my Rand colleague Richard L. Fernandez.

II. RECRUITER TRADEOFFS AND ENLISTMENT SUPPLY

THE PRODUCTION TRADEOFF CURVE

At any given point in time, two types of factors can affect enlistment supply. Environmental or economic factors, such as civilian wages and employment opportunities, will affect propensities to enlist. Enlistment behavior can also be influenced by available recruiting resources, such as the number of recruiters and advertising expenditures. These broad classes of variables characterize enlistment supply.

Previous studies assume that the number of high-quality enlistments is primarily determined by these supply factors. However, recruiters do not passively process enlistments; rather, they have considerable discretion over the allocation of resources, the most important of which is their own time. Recruiters can influence both the quantity and quality of enlistments by engaging in different types of activities—for example, high school "career day" programs, key club meetings, and Eagle Scout gatherings. In contrast, he or she could rely more on "walk-ins" or youth counseling referrals. Also, the recruiter can invest time by screening and selecting candidates with the highest probability of being in the high-quality category.

Figure 1 illustrates a range of hypothetical choices available to an area or group of recruiters as a function of a given level of economic factors and recruiting resources. The solid curve represents the recruiting tradeoff curve, showing all feasible combinations of high (H) and low (L) quality enlistments possible at some point in time.[1] At point A, the area is recruiting 8 high- and 7 low-quality enlistments. However, by altering recruiter behavior, the area can change the mix to include either larger or smaller numbers of high-quality enlistments. For example, as many as 10 high-quality recruits can be secured if no time is invested in obtaining low-quality recruits. As long as total

[1]A tradeoff curve can be used to represent the feasible set of outcomes facing individual recruiters or, alternatively, groups of recruiters. Since recruiters are generally responsible for small geographic areas (determined by high school populations), which are organized into larger "command" or sales units, this interpretation is reasonable.

However, once these quotas are met, additional resources or an improved recruiting climate may not induce increased enlistments. That is, there appear to be few incentives to exceed quotas.

Finally, Sec. IV describes several policy and research applications of the model and the empirical results. The improved identification of resource-allocation effects permits a more accurate computation of the marginal recruiting costs for high-quality enlistments. These costs are significantly lower than suggested by previous research and could be reduced by over 50 percent if appropriate incentives were introduced simultaneously. Until recently, most recruiters have had little difficulty achieving quotas and few incentives to exceed them. Thus, experiments designed to evaluate the impact of enlistment benefits or advertising may wrongly conclude that such resource-changes would have little effect when, under future conditions, they might actually constitute important policy levers. Also, estimated supply relationships indicate that there is a definite tradeoff between enlistment categories. It appears that current recruiter reward programs do not adequately compensate recruiters for the extra effort they must expend to attract high-quality enlistments. Finally, the research affirms that quotas and quota management can profoundly affect both the quantity and quality of enlistments. In large part, that is why projections severely underestimated the rise in Army high-quality enlistments that occurred in 1982. Indeed, computations suggest that at least 36 percent of the 55-percent rise in high-quality Army enlistments could be attributed to changes in quotas. A model that explicitly considered demand factors might have predicted this increase.

influenced by recruiting goals and incentives. Thus, this research explicitly considers the interaction of demand factors and variables characterizing supply in the determination of enlistment outcomes. As a result, the research contributes:

- Better estimates of the impact of supply factors;
- Better estimates of the marginal costs of recruiting high-quality enlistments;
- Measures of the relative marginal costs of recruiting different categories of enlistments; and
- An improved understanding of the importance of enlistment quotas and recruiter incentives to achieve and exceed them.

The remainder of this report comprises three major sections. Section II introduces the concept of production "tradeoffs" between categories of enlistments. The production tradeoff curve represents the range of feasible enlistment outcomes for a given level of supply. Next, a simple model of recruiter behavior illustrates the importance of quotas and incentives in the choice of an outcome along this tradeoff curve. The analysis demonstrates that the enlistments are produced through the simultaneous interaction of both supply and demand factors. This suggests that past research results that ignore demand are likely to have been marred by significant estimation biases.

Section III provides an empirical application of a more general model, using monthly Army enlistment data for 1980 and 1981. The results suggest that the traditional focus on the supply of only high-quality recruits yields estimates that understate the importance of economic and resource allocation factors. That is, changes in such factors as unemployment, relative wage rates, and recruiting resources can affect enlistments more than past studies have indicated. In addition, the estimates quantify the potential recruiting tradeoff between low- and high-quality categories of enlistments.[4] High-quality categories are estimated to be four times as costly to recruit. Finally, the empirical results indicate that enlistment quotas can dramatically affect the allocation of resources. Statistical results suggest that Army recruiters have strong incentives to meet both high- and low-quality quotas.

[4]A high-quality enlistment is conventionally defined as a high school graduate (or senior who will graduate) who performs at or above the 50th percentile on the Armed Forces Qualification Test (AFQT). This definition seems somewhat arbitrary, since there is little convincing evidence that the subsequent performance of such an enlistee is measurably superior to that of others. This research does not consider the relative productivity of recruits; instead it is concerned with the relative cost of recruiting them. Of course, manpower policy must ultimately be concerned with the benefits as well as the costs associated with recruiting high-quality individuals.

Table 2

THE SUPPLY OF HIGH-QUALITY GRADUATES, 1980 AND 1981

	1		2		3	
Variable	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
			1980			
Intercept	.156	1.154	-.259	1.062	-.496	1.256
log(W)	-.348	.223	-.808	.260	-1.014*	.294
log(U)	.544*	.146	.575*	.135	.764*	.167
log(R)	.961*	.130	.842*	.153	1.193*	.152
log(P)	-.087	.132	.070	.127	.091	.150
Feb	-.048	.105	-.045	.097	-.052	.114
Mar	-.005	.106	.004	.098	-.003	.115
Apr	-.105	.106	-.098	.099	-.167	.115
May	-.159	.106	-.145	.099	-.263*	.117
Jun	-.200	.106	-.188	.099	-.203	.114
Jul	.039	.107	.365*	.109	-.117	.117
Aug	.056	.106	.384*	.108	.149	.117
Sep	-.137	.106	.200	.109	-.089	.115
log(Qh)			.420*	.094		
log(Ql)			-.421*	.074		
log(L)					-.393*	.099

Table 2—continued

Variable	1 Coefficient Estimate	1 Standard Error	2 Coefficient Estimate	2 Standard Error	3 Coefficient Estimate	3 Standard Error
			1981			
Intercept	-.442	.935	-.042	.086	-.512	1.018
log(W)	-.293	.197	-.164	.216	-.700*	.273
log(U)	.265	.140	.307*	.131	.506*	.182
log(R)	.834*	.102	.466*	.127	1.086*	.153
log(P)	.062	.107	.009	.100	.098	.118
Feb	-.049	.094	-.049	.087	-.056	.103
Mar	-.010	.095	-.008	.087	-.032	.104
Apr	-.124	.097	-.278*	.093	-.154	.107
May	-.276*	.098	-.430*	.093	-.310*	.107
Jun	-.023	.095	-.182	.092	.021	.105
Jul	.204	.096	-.022	.093	.290*	.110
Aug	.087	.097	-.138	.094	.167	.110
Sep	.025	.097	-.202*	.095	.026	.106
log(Qh)			.459*	.066		
log(Ql)			-.051	.066		
log(*L*)					-.274*	.114

NOTE: See text for explanation of the three sets of estimates.

*Significant at the 5% level.

The reduced-form estimates for the elasticities with respect to economic factors are plausible for 1980. The estimated elasticity with respect to civilian earnings was negative and significant at −.808. In addition, the results indicate that unemployment rates are positively related to the number of high-quality enlistments, holding other supply and demand factors constant. A 10-percent rise in the unemployment rate results in a 5.75-percent increase in the number of high-quality recruits. On the other hand, the effect of the male teenage population appears to be insignificant.[6]

The recruiter elasticity for the completely specified set of reduced-form estimates was positive and significant. For the 1980 data, the elasticity of high-quality recruits with respect to recruiters was estimated to be .842, with a standard error of .153. This is somewhat lower than the estimate derived from the expression that ignores demand factors. This estimate represents a total elasticity. That is, high-quality enlistments will increase by 8.42 percent if the number of recruiters is increased by 10 percent. This predicted increase holds other supply factors as well as demand variables constant. However, the number of low-quality enlistments will, in all probability, also increase if recruiters are added.

The third set of estimates presents coefficients from the supply relationship or tradeoff curve of Eq. (6). The estimated elasticities are uniformly larger in absolute value for all supply variables. This is as expected, since they represent partial elasticities or the expected percentage increase in high-quality enlistments, holding the number of low-quality enlistments constant. Thus, the partial elasticities of high-quality enlistments with respect to civilian wages, unemployment, and recruiters are estimated to be −1.014, 0.764, and 1.193, respectively.

In addition, the tradeoff parameter, λ, was estimated to be −.393 with a standard error of .099. That is, a 10-percent increase in low-quality enlistments would result in nearly a 4-percent decline in the number of high-quality enlistments. Evaluated at the mean values for high- and low-quality graduates, this elasticity estimate yields a trade-

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tions with unemployment rates and the monthly dummy variables are less obvious and, thus, the estimates change very little for these explanatory variables.

[6]This result may surprise some readers. It is interesting to note that the population coefficient is reasonably precise. That is, it is significantly different from a wide range of positive values. This result is plausible if one does not believe that markets are saturated with recruiters. That is, recruiters are already unable, because of time constraints, to contact all potential enlistees. Consequently, an increase in the population does not necessarily increase the number of people contacted. This interpretation makes sense given the rather high recruiter elasticities reported below. Of course, measurement error in the population variable could account for this result.

off of slightly greater than four to one. In other words, a recruiting area, by reallocating effort, could attract one more high-quality enlistment for every four lower-quality enlistments it gives up. High-quality categories are therefore four times as difficult to recruit and four times as costly.[7]

The model was also estimated using 1981 data. For the most part, coefficient estimates for these regressions were similar. In general, however, the elasticities were smaller in magnitude. The elasticities of high-quality enlistments with respect to civilian earnings, unemployment, and recruiters were estimated to be −0.164, 0.307, and 0.466, respectively. However, the coefficient on civilian earnings was not significantly different from zero. The elasticity with respect to the high-quality quota was similar to the 1980 coefficient, 0.459. That is, a 10-percent increase in the high-quality quota yields a 4.59 percent increase in high-quality enlistments. On the other hand, the estimated elasticity of high-quality recruits with respect to low-quality quotas was not significantly different from zero.

The estimated tradeoff elasticity for 1981 was −.274 with a standard error of .114. When evaluated at the 1981 mean values for high- and low-quality enlistments, a four to one tradeoff is obtained. This tradeoff, identical to that derived using 1980 data, again suggests that high-quality enlistments are four times as difficult to recruit as are low-quality. Thus, the cost of recruiting high-quality enlistments is four times as high.

RECRUITER INCENTIVES AND ENLISTMENT SUPPLY

Of course, the previous analysis assumes that recruiters will always have incentives to maintain constant levels of effort and fully use available resources. However, although recruiter success and subsequent promotion depend on production relative to quota allocations, the rewards for overproduction may not, for a variety of reasons, be sufficient to induce maximum effort at all times. Recruiters may

[7]Although the estimations presented focus on the tradeoff between high and low AFQT categories of high school seniors and graduates, such tradeoffs occur between all such categories of enlistments, including nongraduates, reserves, women, and prior service personnel. The analysis and estimation methodology are perfectly applicable to these more finely defined output categories. For example, the tradeoff between high-quality graduates and all other male enlistments, including nongraduates and low AFQT category graduates, was estimated to be between 5 to 1 and 7 to 1. Unfortunately, the quota variables, proxied by accession quotas led three months, were not as reliable for other categories. For example, the size of potential estimation biases due to measurement error was determined, via reverse regressions (see Leamer, 1978) to be significantly larger. Thus, these results are not reported here.

prefer to allocate their time toward leisure activities. Indeed, preliminary evidence suggests that there may even exist disincentives to overproduce. Descriptive regressions of changes in quotas from 1980 to 1981 as a function of various measures of production relative to quotas in 1980 suggest a very strong positive correlation. Recruiters who exceeded quotas in 1980 confronted higher quotas in 1981. If production in one period redefines standards in the next, extreme success may guarantee failure in the future.[8] Thus, despite the outward shift in the locus of recruiting production possibilities, the recruiter may choose a point which is internal to the frontier. Without appropriate incentives, the observed level of enlistments will understate the potential impact of the exogenous shift in market conditions.[9]

To test these propositions, the sample of 33 recruiting areas was divided into two groups for separate analysis. First, the ratio of high-quality enlistments to quotas was computed and averaged for each recruiting area for the two-year period. The mean ratio was .92. That is, recruiters in a representative MEPS area managed to enlist, on average, about 92 percent of their quotas of high-quality enlistments. Half of the sample had average production over 92 percent and were placed in the "high-achiever" group; the other half, who fell below 92 percent, became the "low achiever" group.

The upper half of Table 3 presents the results of estimating the structural supply expression, Eq. (6), for the two groups using the 1980 data set. The differences for the two groups are striking. For the high-achiever group, only the estimated elasticity for population is significantly different from zero and, even so, the negative sign is not plausible. All the other coefficients are insignificant, with large standard errors. Elasticities with respect to earnings and unemployment have incorrect signs. The elasticity with respect to recruiters was estimated to be .475, less than half of the whole sample estimate of 1.193, and not significant at the 5-percent level. The estimate of the tradeoff parameter, λ, was 1.106, though insignificantly different from zero. Taken at face value, this means that recruiters can increase

[8]For example, the elasticity of the percentage change in high-quality quotas with respect to the ratio of high-quality enlistments to quotas in 1980 was estimated to be .474 with a standard error of .048. So, an area which overproduced by 20-percent in 1980 could expect a 10-percent increase in quotas the next year!

[9]This could very well account for the smaller estimated supply elasticities estimated for 1981. On average, recruiters produced only 80 percent of the high-quality quota in 1980. In contrast, average production of high-quality graduates amounted to 115 percent of the goal for this category in 1981. This change was due to improving recruiting conditions as well as a decline in the overall quota for high-quality enlistments. If incentives to exceed quotas are less important than those to achieve them, one would expect a dampened response on the part of recruiters during "good times."

Table 3

THE SUPPLY OF HIGH-QUALITY GRADUATES: HIGH VS. LOW ACHIEVER COMPARISONS, 1980 AND 1981

Variable	Whole Sample		High Achievers		Low Achievers	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
			1980			
Intercept	-.496	1.256	5.851	5.787	-3.123	1.600
log(W)	-1.014*	.294	1.479	.869	-2.891*	.490
log(U)	.764*	.167	-.078	.443	.592*	.229
log(R)	1.193*	.152	.475	.257	1.568*	.194
log(P)	.091	.150	-.370*	.087	-.051	.169
Feb	-.052	.114	-.003	.162	-.019	.134
Mar	-.003	.115	.072	.167	.024	.135
Apr	-.167	.115	.158	.240	-.112	.135
May	-.263*	.117	.221	.349	-.112	.135
Jun	-.203	.114	-.169	.157	-.162	.134
Jul	-.117	.117	.170	.221	.172	.137
Aug	.149	.117	-.018	.187	.162	.138
Sep	-.089	.115	-.171	.159	-.010	.137
log(L)	-.393*	.099	1.106	.762	-.302*	.088

Table 3—continued

Variable	Whole Sample		High Achievers		Low Achievers	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
			1981			
Intercept	-.512	1.018	2.996	1.668	1.783	1.454
log(W)	-.700*	.273	.707*	.284	-2.178*	.433
log(U)	.506*	.182	-.411	.283	.552*	.229
log(R)	1.086*	.153	.624*	.165	1.553*	.234
log(P)	.098	.118	-.273*	.049	-.019	.152
Feb	-.056	.103	-.079	.109	-.046	.121
Mar	-.032	.104	.052	.111	-.083	.122
Apr	-.154	.107	-.110	.114	-.183	.125
May	-.310*	.107	-.432*	.115	-.210	.125
Jun	.021	.105	-.140	.119	.038	.122
Jul	.290*	.110	-.015	.130	.361*	.128
Aug	.167	.110	-.108	.132	.224	.128
Sep	.026	.106	-.144	.115	.204	.124
log(L)	-.274*	.114	.452*	.193	-.290*	.117

*Significant at the 5% level.

high-quality enlistments at the same time that low-quality categories are increased. It is clear that, in comparison with the results for the whole sample, the estimates of the supply parameters using the overproducer group are quite implausible. (For this group, the estimates probably trace choices of points inside the recruiting tradeoff curve.)

The results for low achievers, found in the third set of coefficient estimates, are dramatically different. Indeed, the estimates conform nicely to a priori expectations. The estimated coefficients for demographic variables are significant and appropriately signed. Of particular interest is the rather large wage elasticity of −2.891. That is, a 10-percent rise in the civilian manufacturing wage rate would result in a 28.9-percent decline in high-quality enlistments, all things equal. In addition, the recruiter elasticity is estimated to be much larger than in the sample as a whole. A 10-percent increase in the number of recruiters would result in a greater than 15-percent rise in high-quality enlistments, holding the number of low-quality recruits constant. Finally, the tradeoff parameter was estimated to be −.302, confirming that lower-quality enlistments require significant expenditures of scarce recruiting resources.

The comparisons of estimates using 1981 data, as reported in the lower half of Table 3, are quite similar. Once again, the elasticity estimates for high-achieving areas differ strikingly from those derived from the complete sample of observations. The elasticities with respect to earnings, population, and unemployment do not confirm theoretical expectations. The elasticity of high-quality enlistments with respect to recruiters is positive and significant, but much lower at .624 than the estimate for the whole sample. Once again, the tradeoff parameter, λ, is estimated to be positive, a counterintuitive result. It is apparent that the estimations do not accurately reflect the supply relationships of interest.

Estimates for the low-achiever areas again conform to theoretical expectations. The elasticity of high-quality enlistments with respect to the civilian wage opportunities is −2.178, with a standard error of .433. For unemployment, the elasticity is .552. Once again, these coefficients suggest that, in areas where recruiters are not typically achieving quotas, the number of high-quality enlistments is more elastic with respect to economic changes than in areas characterized by overproduction. For recruiters, the estimated elasticity is virtually the same as that from the 1980 data. The estimated tradeoff parameter again indicates that a 10-percent decline in low-quality enlistments yields about a 3-percent increase in high-quality enlistments. In other words, high-quality enlistments are again computed to be about four times as difficult to recruit.

The rather stark and consistent divergence in the estimated supply parameters is quite convincing. Supply elasticities are generally not significant and often have implausible signs for areas where quotas are consistently achieved. Moreover, increased resource expenditures on additional recruiters have only limited effects on the number of high-quality enlistments. There is a strong implication that recruiters in such areas have few incentives to increase production, because of an improved climate once quotas have already been achieved. To some extent, enlistments might increase, but it seems clear that recruiters will not be motivated to maximize the market's potential and take full advantage of economic or resource changes.

Unfortunately, it appears that observed enlistments in such circumstances do not represent the supply tradeoff curve, but instead are internal points. To the extent that some recruiters and recruiter managers may be more motivated than others to exceed quotas, one might expect a positive relationship between numbers of high- and low-quality enlistments for these areas. That is, once quotas are achieved, some areas will exhibit no increases in enlistments of any type, despite economic or resource effects that would shift the supply or tradeoff curve outward. Other areas might be so motivated and one would observe a point closer to the frontier of the supply possibility curve. That is, such areas could exhibit higher numbers of both high- and low-quality enlistments. Thus, for this subset of recruiting areas, there exists a correlation between high and low quality that is not representative of any supply relationship but, instead, reflects systematic differences in recruiter behavior.

On the other hand, the results for low achievers are quite satisfactory. Certainly, the coefficients are "well behaved." That is, they conform to theoretical expectations as well as previous estimations. Most convincingly, they are remarkably similar for the two years. Coefficient estimates are quite precise and do not differ significantly for the different periods. In general, the results suggest that, if recruiter incentives are taken into account, estimated enlistment responses to changes in economic factors and resource expenditures will be greater.

STRUCTURAL DEMAND AND SUPPLY ESTIMATES

As indicated, the above results were obtained by jointly estimating an approximation to a reduced-form expression for low-quality graduates along with the structural supply relationship Eq. (6). However, it is possible, though costly, to use Eq. (10), which can be directly derived from an explicit expression for recruiting objectives, Eq. (9). This exercise was undertaken for two important reasons. First, it indicates how sensitive the supply elasticity results are to the specification of demand relationships. Second, the estimates of demand parameters can provide more direct information on the nature and significance of recruiting objectives in the determination of enlistment supply. Table 4 presents the results of a nonlinear two-stage estimation procedure as applied to both structural expressions—(6) and (10)—for the low-achiever groups for both 1980 and 1981.[10]

The estimated supply parameters were virtually identical to those obtained using the more simple estimating methodology. The elasticities with respect to unemployment, civilian wages, and recruiters all fall within a standard deviation of those derived using the simpler methodology. In addition, the tradeoff parameter estimates, −.367 and −.274 for 1980 and 1981, respectively, are remarkably close to the −.302 and −.290 reported earlier. This assures us that the results for the supply relationships are not sensitive to the functional representation of demand factors.

The model was estimated under the assumption that recruiters must, at a minimum, achieve the total volume mission. That is, the ratio of

Table 4

STRUCTURAL MODEL ESTIMATES: RECRUITER OBJECTIVES AND ENLISTMENT SUPPLY

	1980		1981	
Parameters	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Supply parameters				
log(U)	.658	.250	.535	.267
log(W)	-3.100	.569	-2.142	.516
log(R)	1.647	.218	1.529	.304
log(L)	-.367	.120	-.274	.167
Demand parameters				
θ	.755	.080	.825	.107
γ_h	.973	.043	.929	.034

[10]See Berndt, Hall, Hall, and Hausman (1974) for a description of the computational procedure.

total enlistments to the total quota must be at least 1.[11] With the subsistence parameter, γ_t, constrained to be equal to 1, Eq. (9), which specifies recruiting objectives or demand, becomes:

$$U = \theta\log[(H/Q_h) - \gamma_h] + (1 - \theta)\log[(T/Q_t) - 1] \qquad (11)$$

Again, T is the total number of enlistments and the Q's are enlistment quotas. The high-quality subsistence parameter, γ_h, was estimated to be .973 for 1980, with a standard deviation of .043. For 1981, the estimate was .929 with a standard error of .034. This suggests that recruiters take their quotas for high-quality enlistments quite seriously. That is, the data indicate that the minimum acceptable number of high-quality enlistments is perceived to be very close to the production quota or goal. The estimates of the parameter θ, 0.755, and 0.825, are not significantly different for 1980 and 1981. This parameter indicates the relative weight placed on production of high- versus low-quality enlistments in recruiting objectives.[12] The relative importance of high-quality enlistments, given by the ratio $\theta/(1 - \theta)$, is therefore computed to be 3.08 in 1980. On the margin, high-quality enlistments are more highly valued by recruiters.

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[11]This restriction facilitated the convergence of the estimates to the maximum likelihood solution. Likelihood ratio tests comparing the sum of residuals for the restricted versus unrestricted reduced-form expressions for high-quality graduates permitted rejection of the hypothesis that the restriction decreased explanatory power. This fact, along with the testimony of several recruiters who claimed that they did, indeed, behave in this manner, seemed to justify the parameter restriction on the grounds of computational convenience.

[12]Strictly speaking, the marginal rate of substitution of high- for low-quality enlistments in recruiting objectives also depends upon the value of the shift or subsistence parameters, γ_h and γ_t. That is, the weight parameter, θ, indicates the relative importance of "supernumerary" enlistment production. If the values of the γ's are in the neighborhood of (1,1), the estimate of θ can be interpreted as signifying the relative importance placed on high- and low-quality graduates.

'. RESEARCH APPLICATIONS AND FUTURE IMPLICATIONS

his section introduces several policy and research applications of research. The estimated supply effects have important implica- ı for the likely impact of demographic and economic changes as as for the importance of resource allocations. New estimates of ginal recruiting costs are computed and issues concerning the ts of enlistment benefits experiments are discussed. The nated tradeoff between categories of enlistments yields relative ıiting-costs estimates and suggests management strategies that produce more effective incentive and reward systems. Finally, irical results have demonstrated the importance of demand factors etermining both the quantity and quality of enlistments. Thus, ection models and the resulting forecasts of enlistment supply are y to be severely marred by the exclusion of these factors. Rough ılations suggest that the failure of models to predict the 1982 eases in high-quality enlistments stems from these deficiencies.

E IMPACT OF THE CHANGING ECONOMY

ıllowing for recruiter behavior yields estimated supply elasticities of ı-quality enlistments with respect to unemployment and civilian es that are significantly higher. For example, the estimated elasti- with respect to earnings was −.348 in 1980, based on an OLS ession that excludes quotas. On the other hand, the estimate from ımple of low achievers, holding low-quality recruits constant, was ;91. Thus, one would conclude that economic recovery and the ›ciated increase in civilian wages and decline in unemployment ld have rather dramatic effects on enlistments.

)uring the first part of 1983, virtually all recruiters and recruiting ricts were managing to exceed quotas quite easily. That is, nearly of them could be characterized as "high achievers." Thus, enlist- ıts were probably less than the market potential. If so, observed luction was demand-constrained and did not represent feasible sup- When the economy began its expansion and the supply tradeoff /e shifted inward, the adverse impact on enlistments may have been igated because recruiters then had incentives to try harder to fully the resources at their disposal. Thus, although economic factors ıay be more important than was previously believed, adjustments in ecruiter effort might reduce the impact.[1]

IARGINAL COSTS OF HIGH-QUALITY ENLISTMENTS

The tradeoff model and estimated coefficients have important ramications for recruiting resource allocations. In particular, we have seen ıat the elasticity of high-quality enlistments with respect to recruiters significantly higher if the number of low-quality enlistments is held onstant. Additional resource expenditures can therefore result in reater increases in high-quality enlistments if recruiters are induced to oncentrate on activities that will attract them instead of lower-quality nlistments. We have also seen that resources are more effective in reas that have strong incentives to increase production.

These factors suggest that the resource costs associated with ıcreasing enlistments will vary considerably, depending on recruiter ıcentives to allocate effort. For example, the 1980 recruiter elasticity f high-quality enlistments was .842. Again, this represents a total lasticity, computed under the assumption that the additional ecruiters will, at the same time, be motivated to produce lower-quality nlistments. This elasticity, when evaluated at the mean values for nlistments and recruiter numbers, yields an estimate of the additional ecruiting resources necessary to produce an additional high-quality nlistment. In 1980, the 76 Army recruiters in our representative IEPS produced 40 high-quality enlistments monthly. An additional nlistment represents a 2.5 percent rise in high quality to 41. Given ıe elasticity of .842, this increase would require about a 3.0 percent ıcrease in the number of recruiters (2.5/0.842). That is, it would take bout 2.257 additional recruiters to produce a single high-quality enlistıent. Assuming that a recruiter costs the Army about $3,000 monthly, ıe marginal cost to recruit a high-quality person becomes approximaely $6,800. Since the percentage standard deviation of the estimated lasticity was about 18 percent, a 95-percent confidence interval ranges om $4,300 to $9,300.[2]

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[1]As discussed below, this result may depend on the position of quota levels relative to ıe range of feasible supply outcomes. We will see that, if quota levels become unrealisc, recruiter effort might actually diminish, thereby causing dramatic changes in oserved production.

[2]These calculations should be interpreted very cautiously. First, they represent marnal costs for very small increases in the recruiting forces. It is not possible that the asticities would remain constant for large changes in manpower. Unfortunately, the me series and cross-section variations in the data do not permit analysis of more amatic scenarios. In addition, the standard errors for coefficients do not straightrwardly translate to prediction confidence intervals. However, the associated bias is ot likely to be very important relative to other potential difficulties discussed below.

ɔurse, the above computation allocates all increased recruiting the additional high-quality recruit. We have seen, however, ruiters, if not constrained, will expend some effort to attract ıality enlistments at the expense of high-quality. Thus, to accurate measures of the marginal recruiting costs for high-enlistments, one must hold low-quality enlistments constant ıpute marginal costs from the partial elasticities of the tradeoff expression. The resulting estimates can thus be interpreted as ıe marginal recruiting costs of an additional high-quality enlist-ıolding everything else, including the number of low-quality ents, constant. For example, the partial elasticity of high-enlistments was estimated to be 1.193. In other words, when rs are not permitted to increase numbers of low-quality , the same addition to the recruiting force would yield 42 per-ɔre high-quality recruits than otherwise.

ldition, recall that estimated recruiter elasticities are greater for s that typically produce below quota levels. Presumably, these es more accurately reflect true supply relationships because cruiters have higher incentives to take advantage of increased es and market improvements. Thus, the productivity of addi-ecruiters will be higher if quotas are set high enough to induce ım production. Additions to the recruiting force will have a impact and marginal costs will be lower if quotas are increased neously.

also possible to compute the marginal cost of adding one high-recruit while maintaining the total number of recruits. Thus, enlistment totals remain the same while the quality mix is *in favor of higher categories.* Fewer additional recruiters are d because resources are simultaneously reallocated to the pro-ı of higher-quality enlistments. That is, a one-unit increase in ıthly production of high-quality enlistments for recruiters in a ntative MEPS allows for an equivalent decline in low-quality ıents if the total number of recruits is constrained to stay the This reallocation will decrease the marginal recruiting cost by rcent.[3]

e the mean production of low-quality recruits was 76 in 1980, a one-unit decline ts 1.3 percent. The tradeoff elasticity of high for low quality was about −.3. ıe 1.3 percent decline in low-quality enlistments will permit a .39 percent in high-quality (−.3 × 1.3) without any additional recruiting resources. If one ıl high-quality recruit amounts to a 2.5-percent increase (1/40), the .39 percent igh-quality enlistments due to resource reallocation will save about 15.6 percent nal recruiting costs (.39/2.5).

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ultiple enlistment categories by service with explicit consideration of emand influences.[15]

Finally, the modeling of demand factors here, though illustrative and f demonstrated empirical importance, was somewhat simplistic. A aive model of demand suggests that quotas will affect recruiters in a redictable manner. However, preliminary attempts to model incen- ves more formally suggest that the relationships between quotas, otential supply, relative rewards, and recruiting effort can become uite complex. These complexities can have profound implications for e efficient management of recruiting resources as well as for the ppropriate estimating model to account for such demand factors. uture work must explicitly imbed such factors as the allocation of fort and the role of recruiter rewards, assess their importance, and rovide empirical estimates that will document the interaction between ese factors, supply conditions, and resource expenditures.

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[15]For example, assume that the existence of the Army Ultra-VEAP had a negative npact on the Navy's ability to attract high-quality enlistments. However, imagine that, ecause of good recruiting times, Army recruiters did not take full advantage of their nhanced ability or Navy recruiters were so easily meeting all quotas before the program at it caused no discernible changes in high-quality enlistments. An analysis that did ot consider these factors could conclude, perhaps wrongly, that the cross-service effects e negligible. Unfortunately, the same program under more difficult conditions could ave a much different impact.

derived previously. In addition, the recent inability of projection ls to predict the large rise in high-quality enlistments is largely o the failure to include demand factors in the analysis.

though the importance of demand factors has been adequately nstrated, much work remains to be done before estimated parame- of policy interest can be used with much confidence. To begin , the estimations reported here were made using an aggregate -81 Army data set that had several limitations. Most important, ariables thought to reflect demand factors were based on accession as instead of the unavailable contract quotas. Statistical tests ated that the coefficient estimates were probably biased toward .[14] For this reason, the results should be interpreted cautiously ling further work using a more reliable data base. The compari- will probably not be qualitatively affected using alternative esti- ion and modeling strategies. Thus, most of the conclusions will not aterially altered.

n addition, the absence of any measures of alternative resource nditures meant that marginal cost estimates were limited to uiting. Results indicate that marginal recruiting costs are likely to much lower than previously believed. However, the relative effi- cy of recruiters vis-a-vis advertising or bonuses cannot be evaluated out further work. Also, the analysis was limited to consideration ery broad categories of recruits. In reality, several other categories nlistments exist that may involve important recruiter tradeoff deci- s. Less-aggregated categories of AFQT scores, reserves, women, prior service enlistments may be viewed as separately identifiable groups for analysis. Future work should therefore extend the hodology from two to multiple categories of *enlistments*.

lso, some of the more pressing manpower controversies concern the petitive or interservice effects of resource expenditures. For exam- how do Army enlistment benefits affect Navy recruiting? Are the ices playing a "zero-sum game" or do enlistments come from arate pools of potential recruits? Is service-specific or joint ertising more efficient? Such issues can only be analyzed in the text of a model that simultaneously considers the determination of

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[4]In particular, several reverse regressions for reduced-form and structural equations run. The implied coefficient values establish an upper bound and indicate a feasi- range of estimates in the presence of errors in the variables. See Leamer (1978), pp. -245. For the quotas, the reduced-form elasticities had an estimated upper bound of an unreasonably high level which, though not feasible, probably indicates the pres- of significant measurement error. The upshot is that the actual elasticities are most ly higher than estimated.

for recruiters who overproduce than for those either below or just achieving quotas. Most recruiters were meeting quotas in fiscal 1982. For this reason, the elasticity for high-quality enlistments in an environment of overproduction is likely to be higher than those estimated for the different circumstances of 1981. For suggestive evidence to support such an extreme outcome, note that the 54-percent increase in high-quality quotas correlates quite well with the actual rise in high-quality enlistments.

Projection models, if they are to be accurate, must explicitly model factors affecting demand as well as supply. Obviously, the simple inclusion of quota variables is based on a model of recruiter behavior that is quite naive and likely to yield only approximate corrections to predictions based on supply factors only. A more appropriate model of recruiter behavior must be used if aggregate projection models are to account for the changing demand factors, which can have profound implications for the quality and quantity of enlistments.

CONCLUSIONS

The research reported here developed and applied a modeling and estimation methodology that explicitly considers the role of demand factors in the determination of enlistments. To this point, the work has demonstrated the deficiencies of the traditional focus on the supply of single categories of recruits. We have seen that recruiters, by allocating their time in response to goals—and the incentives to meet and exceed these goals—can alter their output of enlistments. The estimations indicate that the tradeoff between high and low AFQT category high school graduates is about four to one. Ignoring this tradeoff and the demand factors affecting recruiting choices can yield incorrect estimates of the effects of economic factors and resource expenditures. In general, the estimated elasticities of high-quality enlistments with respect to variables such as the unemployment rate, civilian wages, and the number of recruiters are significantly higher if the potential tradeoff is considered and the number of low-quality enlistments is constrained. Also, recruiter quotas can dramatically affect the allocation of resources. In 1980 and 1981, for example, Army recruiters had incentives to meet both high- and low-quality quotas. However, the evidence strongly suggests that once these quotas were met, additional resources or an improved climate would not have increased the number of contracts at the same rate. Computations suggest that, as a result, estimates of the marginal recruiting costs are significantly lower than ıcrease, when the changing enlistment mix is considered, was only 64 ercent as high as the observed rise in high-quality enlistments. The ımaining 36 percent can be assumed to be the result of changes in the mphasis of recruiters.[12]

The demand factors that caused the switch in recruiting emphasis an be seen in the comparison of aggregate quotas for 1981 and 1982, eported in Table 8. The quotas for high-quality enlistments increased ɔ 45,391 in 1982, an increase of 54 percent. On the other hand, the uotas for low AFQT categories fell by 12 percent, from 52,133 to 5,968. Applying the estimated elasticities of high-quality enlistments ith respect to the quotas yields a crude approximation for the changes n production. Calculations based on the 1980 and 1981 elasticities uggest that one could have anticipated an increase of between 26 and 8 percent, about half the total simply because quotas were changed.

There is reason to believe that the actual impact on production was ven more substantial. First, one suspects that measurement error in he quota variables has led to an understatement of the estimated elasicities.[13] Secondly, the impact of quotas was seen to be much greater

Table 8

QUOTA CHANGES AND THE PROJECTION OF HIGH-QUALITY ENLISTMENTS

				Predicted Change in High-Quality Enlistments	
Quota	1981	1982	% Change	1980	1981
High quality	29,408	45,391	+54%	23%	25%
Low quality	52,133	45,968	-12%	5%	1%
Total predicted change				28%	26%

[12]Of course, these results are tentative and depend on accurate estimates of the tradeıff parameters. Results reported below suggest that the estimated weights probably overıtate the relative difficulty of attracting high-quality recruits. This implies that the neasure of total weighted output went up by even less than 35 percent. Thus, producion increases in high-quality enlistments are, to a significant extent, due to changes in lemand factors.

[13]Recall that accession quotas were led three months to proxy for contract quotas. Reverse regressions suggested that the likely bias due to measurement error is substanial. See Leamer (1978).

Table 7

WEIGHTED OUTPUT MEASURES: ENLISTMENT INCREASES IN 1981 AND 1982

Item	Number of Enlistments 1981	1982	% Change
High school			
I-IIIA	33,820	52,328	+55
IIIB-IV	45,356	45,873	+ 1
Nongraduates	23,331	14,624	-37
Weighted output			
High school	44,882	63,516	+42
Nongraduates	3,888	2,437	-37
Total	48,770	65,953	+35

time, the number of lower-aptitude high school graduates remained relatively constant while the number of nongraduates fell to 14,624 from 23,331, a 37-percent decline.

Clearly, at least some portion of the 55-percent increase in the production of high-quality recruits was due to the decline in lower-quality categories of enlistments. Resources, such as recruiter time, were released from the attraction and processing of nongraduates to the enlistment of higher-quality graduates. Such a reallocation of effort does not involve different aggregate resource expenditures and would not be accounted for in a methodology that models a single category of enlistments as a function of factors affecting supply only.

To illustrate, the estimated tradeoff parameters, measuring the relative difficulty of recruiting different categories, can be employed as factors to derive a weighted output measure. That is, elasticity estimates reported earlier suggested that high-quality graduates were about four and six times as difficult to enlist as low-quality graduates and nongraduates, respectively. Thus, dividing the latter categories by the weights and summing over all types yields a measure of total output reported in Table 7. The measure of production increased by 35 percent, from 48,770 to 65,953 in 1982. Thus, the real productivity

However, it is crucial to emphasize that the dramatically different responses of recruiters to changes in supply and to quotas stem not only from the structure of the reward system, but also from the relative rewards given for enlisting different categories of recruits. The reward system should more accurately reflect the relative difficulty of attracting high- and low-quality enlistments in the vicinity of the preferred enlistment mix. An increase in the relative points awarded to high-quality enlistments to correspond with the 4/1 tradeoff estimated would decrease the slope of the isopoint lines and create a different series of point-maximizing tangencies that would represent higher levels of high-quality enlistments. Ideally, one of these tangencies would occur at the quota level and the erratic recruiter allocation shifts in response to supply changes could be eliminated.[10]

ENLISTMENT PROJECTIONS AND THE INFLUENCE OF DEMAND FACTORS

If military manpower requirements are to be met, policymakers must be able to anticipate economic changes and respond with appropriate resource allocations. Enlistment projections, based on predictions of supply models, play a pivotal role in this process. Unfortunately, recent projections have proven to be somewhat inaccurate, failing to anticipate the rather dramatic increase in the number of high-quality recruits that have enlisted. In particular, Army high-quality enlistments increased by over 50 percent from 1981 to 1982. Typically, projections of high-quality Army enlistments represented only about 70 percent of the eventual numbers for 1982.[11]

These failures stem largely from applying traditional supply modeling without considering the simultaneous importance of demand factors and production tradeoffs between various categories of recruits. For example, Table 7 illustrates the changing enlistment mix and the likely impact of changing incentives on the number of high-quality Army enlistments. Between 1981 and 1982, high-quality Army enlistments increased from 33,820 to 52,328, a rise of 55 percent. At the same

[10]Given the long lag associated with the actual setting of enlistment quotas, it might be preferable to restructure the quota system so as to increase flexibility. In the future, it might be better to use a system that evaluates recruiters' performance relative to that of their peers. Thus, standards will automatically adjust as a function of the changing supply conditions.

[11]The best examples are recent projections reported by Robert Cotterman and Lawrence Goldberg in unpublished manuscripts. They predicted that enlistments, under plausible economic scenarios, would have been about 35,000 in fiscal 1982. The underlying supply models did not consider the simultaneous importance of demand factors. In defense of the authors, however, the requisite quota data did not exist for earlier periods.

maximize points by choosing point B. Point Q, which represents enlistment goals, is unattainable, but only barely so. With a slight increase in supply, however, the recruiter will choose point Q and earn the bonus points. Note that a very slight increase in supply, or, alternatively, a very small decrease in the quota, could result in an extremely large reallocation effort toward high-quality enlistments.

Underproducers will, as supply increases, move along the line AB, representing the point-maximizing tangencies. After B, the recruiter will have an incentive to drastically change behavior to achieve Q. After attaining the quota, however, the recruiter is again faced with a point allocation that rewards high- and low-quality enlistments in an 8/5 ratio.[8] This means that, to maximize points, the recruiter will once again allocate effort to achieve the tangency points between the isopoint lines representing rewards and the tradeoff curves, but subject to the constraint that quotas are achieved. Thus, as supply shifts to make points beyond Q feasible, the recruiter will move along the segment QC and then CD, thus maximizing points. Note that for a range beyond the quota, the recruiter will have no incentive to add any high-quality enlistments! An increase in the quota over this range can have dramatic effects on the allocation of time and, therefore, the number of high-quality enlistments.

In summary, the impact of changes in quotas on the number of high-quality enlistments can vary dramatically, depending on the ability of recruiters to achieve them. For recruiters unable to meet quotas, along the segment AB, an increase in the quota will have no effect. On the other hand, recruiters slightly above quota, from Q to C, will increase high-quality enlistments in response to quota increases. However, those far in excess of the quota, along CD, may have no incentive to respond to quota increases. On the other hand, recruiters who face supply tradeoff curves that are in the region of the quota, may make dramatic changes in response to quota changes. A slight increase in the quota for recruiters who are having a difficult time achieving it could give them incentives to reallocate effort more toward low-quality enlistments.[9]

Clearly, the accurate setting of quotas is of paramount importance if recruiter behavior is to be consistent with overall enlistment objectives.

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[8]In actuality, overproduction is rewarded by twice as much, with 16 points for every high-quality and 10 points for every low-quality enlistment in excess of the quota. However, the 8/5 ratio is maintained.

[9]Of course, these arguments depend on the point ratio, which we know to be 8/5, being smaller than the relative difficulty of recruiting high- and low-quality enlistments. The latter has been estimated to be approximately 4/1, so it appears that incentives to overproduce low-quality vis-a-vis higher-quality recruits do exist.

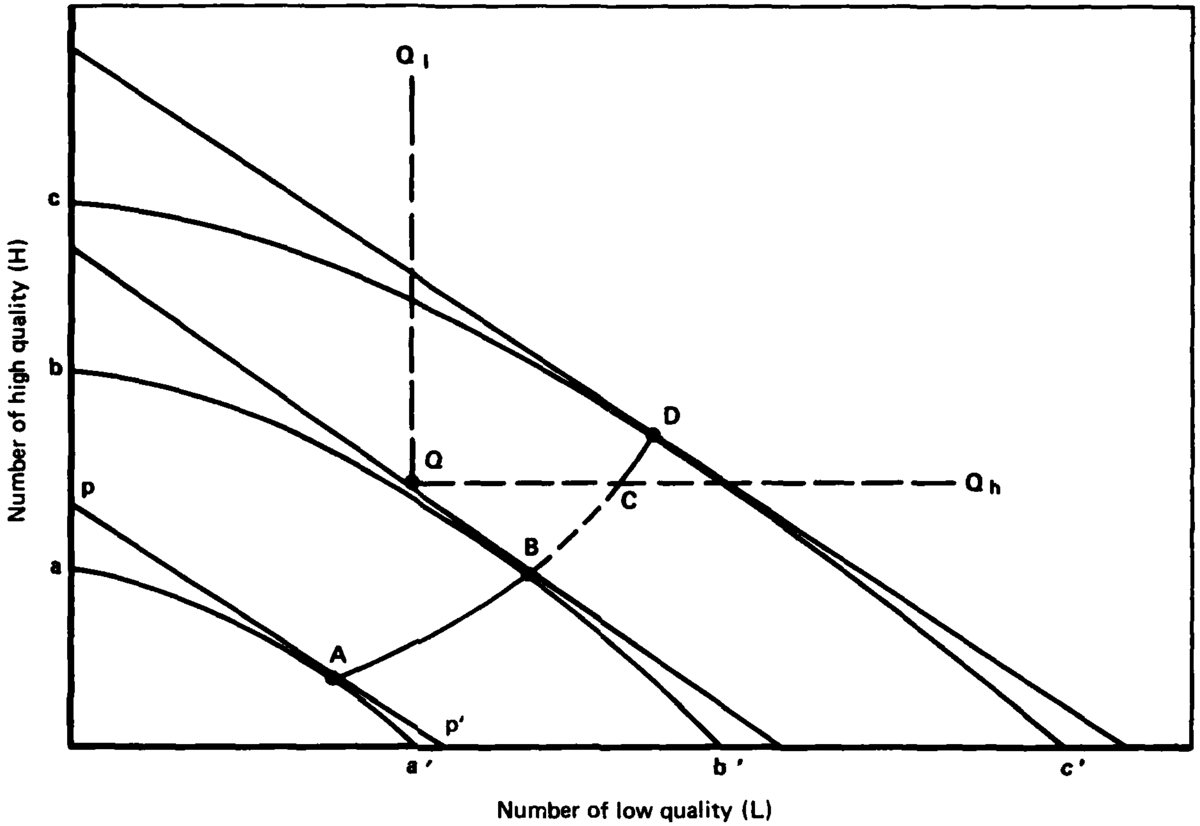

Fig. 3—Rewards, incentives, and recruiter behavior

points by going after the easier low categories. On the other hand, if enlistment quotas are lowered, a reallocation of effort toward high quality might occur simply because the bonus becomes attainable. Thus, we have the surprising result that lower high-quality quotas may actually induce an increase in high-quality enlistments. For overproducers, the bonus is already earned and point maximization will probably induce increased production of the lower-quality categories. For such recruiters, an increase in high-quality quotas would likely induce increased enlistments of high-quality categories.[7]

Figure 3 illustrates the way the recruiter reward system and quotas interact to affect the allocation of effort. The tradeoff curves aa′, bb′, and cc′ represent the recruiting possibilities under three sets of circumstances. Recall that points along these curves represent all combinations of high- and low-quality enlistments that are feasible, given current market conditions and levels of recruiting resources. Say that the quota levels for high- and low-quality enlistments are given by point Q. Clearly, these quotas are beyond the feasible set of production points represented by the tradeoff curves aa′ and bb′. However, they are attainable under the supply circumstances represented by the tradeoff curve cc′.

Now, assume that recruiter points are allocated in the aforementioned 8/5 ratio and that recruiters attempt to maximize their totals. Different point levels are represented by a series of parallel lines indicating all combinations of enlistments that sum to a given total. For example, the "isopoint" line representing 40 points will include the production of either 5 high-quality enlistments, 8 low-quality enlistments, or some combination of the two. The slope of the isopoint lines is −5/8, representing the relative reward points. The recruiter will attempt to achieve the highest point total possible, subject to the supply conditions at the time. Under conditions represented by aa′, the recruiter will choose point A. Any other feasible combination of enlistments will be on an isopoint line representing a lower total. The point-maximizing points of production can be represented by a series of tangencies between the tradeoff curves and the isopoint lines.

However, under current recruiter reward schemes, bonus points are allocated when enlistments are equal to quotas. Say that, under supply circumstances characterized by the tradeoff curve bb′, the recruiter will

[7]For example, it is possible that the very recent downturn in Army recruiting is not solely due to the economic recovery. Instead, it may be largely due to the result of high-quality quotas being set unrealistically high. Suddenly unable to achieve quotas, recruiters have fewer incentives to secure high-quality recruits. Thus, the enlistment response to better civilian opportunities is aggravated by the structure of recruiter rewards.

Although the estimated increase for the whole sample provides an accurate retrospective measure of the impact of the program, it is less valuable in assessing the potential importance of educational benefits as a policy lever. Clearly, the enlistment response will vary as demand conditions and recruiter incentives vary. It is likely that, under conditions characterized by overproduction for most recruiters, the program would have a limited enlistment effect. On the other hand, given appropriate incentives, the relationships estimated for the low-achievers group could be induced for all recruiters. The effectiveness of any enlistment benefits program will depend on the incentives of recruiters to increase production in response.

RECRUITER REWARDS AND THE TRADEOFF PARAMETER

As suggested earlier, the estimated elasticity of high-quality with respect to lower-quality enlistments, the tradeoff parameter, indicates the relative difficulty of enlisting the two categories. Evaluated at the sample mean, this estimate suggests that recruiters can produce an additional high-quality enlistment by giving up about four low-quality enlistments. At the same time, recruiter incentive programs are meant to recognize this relative difficulty and provide commensurate rewards. In particular, recruiters are awarded points for producing enlistments in various categories. Currently, the Army awards underproducers 8 points for a high-quality enlistment and 5 points for the lower category. If securing high-quality categories is four times as difficult, recruiters, to the extent they are point-maximizers, will have an incentive to go after the relatively easier low-quality enlistments. However, since the reward structure provides a rather large point bonus for achieving quotas, recruiters may have an incentive to reallocate effort toward high-quality enlistments.[6] After achieving the quota, however, the relative difficulty of high-quality enlistments will probably induce reallocation toward the low-quality categories.

The recruiter reward program greatly complicates the relationship between production and quotas. If quotas are set too high, recruiters have few incentives to go after the more difficult categories of enlistments. They have no chance to earn the bonus, but can maximize

[6]In particular, the Army rewards recruiters with 30 bonus points if they achieve the quotas for high- and low-quality recruits. Consequently, even if a recruiter can secure 4 more low-quality enlistments at the cost of a single high-quality one, the bonus points will, on the margin, prevent him from doing so. That is, $(4 \times 5 = 20)$ is less than $(8 + 30 = 38)$.

Ultra-VEAP kickers, indicated that they raised high-quality Army enlistments by about 9 percent.[4] The same regression model was employed for this report, except that measures of high- and low-quality quotas were introduced to account for possible demand effects. In addition, the sample was divided into the high- and low-achiever groups in order to assess the importance of recruiter incentives. Table 6 compares the results for the Ultra-VEAP kicker for the whole sample and for each subset separately.

The increase in high-quality enlistments due to the Ultra-VEAP kicker was estimated to be just under 11 percent. This estimate, though slightly higher, is qualitatively consistent with previous estimates.[5] However, the estimated impact was significantly different for the two groups of recruiting areas. In particular, the increase in high-quality recruits was estimated to be 6.7 percent for high-achieving areas. In contrast, the estimated coefficient for low-achieving areas was more than twice as high and was statistically significant. For these areas, the Ultra-VEAP kicker increased high-quality enlistments by 16 percent.

Table 6

EFFECT OF THE ULTRA-VEAP KICKER
ON HIGH-QUALITY ENLISTMENTS

Sample	Coefficient	Standard Error
Whole sample	.109	.031
High achievers	.067	.039
Low achievers	.160	.063

[4] See Fernandez (1982). The regression model employed in this work converted enlistments and exogenous variables from levels to measures of the year-to-year changes in their values. For assessing the impact of a controlled experimental difference between areas, this methodology is appropriate. However, in the presence of substantial measurement error in the other exogenous variables, the analysis of other coefficients must be cautiously interpreted. Alternative estimating approaches, though, did not change the magnitude of the variable of policy interest in this case. The coefficient on the Ultra-VEAP proved to be extremely robust, regardless of model specification.

[5] Analysis indicated that the group of areas affected by the Ultra-VEAP kicker exhibited small decreases in their high-quality quotas relative to their control group counterparts. This correlation between changes in quotas and the existence of the program accounts for the increase in the estimated effect from about 9 to 11 percent.

parameter, to compute the marginal cost of adding a high-quality recruit while decreasing the number of low-quality recruits so that total enlistments remain constant. These costs are lower since the reduction in low-quality enlistments frees recruiting resources for the production of higher-quality categories. Using the elasticities for low-achieving areas, the computed marginal costs are $2,900 with a percentage standard error of 12 percent for 1980, and $2,300 with a standard error of 15 percent for 1981.

Clearly, the marginal cost estimates vary considerably depending on the elasticity estimate employed. The computed marginal recruiting cost of a high-quality enlistment is over $10,000 if recruiters are permitted to increase the numbers of low-quality enlistments simultaneously. In contrast, if recruiters are given appropriate incentives with sufficiently challenging quotas and are induced to add high-quality while equivalently reducing low-quality production, the computed cost can be as much as 75 percent lower. Evidently, enlistment quotas and appropriate incentives to achieve them can make quite a difference in the effect of recruiting resource expenditures.

Although the available data did not permit an analysis of the effects of alternative resource expenditures, such as advertising and enlistment bonuses, the previous analysis of marginal recruiting costs indicates that estimates are likely to be significantly affected when demand factors are explicitly and simultaneously considered. Unfortunately, comparisons of the relative effectiveness of alternative resource expenditures must await further work. However, marginal cost computations for recruiting suggest that, in general, enlistment benefits packages can be made more efficient if recruiters are given appropriate incentives to take full advantage of the increased opportunity to attract high-quality candidates.

The role of demand factors is likely to be extremely critical for evaluating the enlistment bonus and advertising mix experiments. At the present time, recruiting success is at an unprecedented level. Even the "low achieving" recruiting districts are easily exceeding high-quality quotas. In such an environment, recruiters who are given the extra advantage of an enlistment bonus or increased advertising expenditures may not respond as they would under conditions marked by underproduction relative to quota. Thus, any evaluation of the potential effectiveness of these resource expenditures must consider their likely impact under different circumstances.

The importance of such considerations can be illustrated by a reanalysis of the estimated enlistment effects of the 1981 veterans' educational assistance program (VEAP) test, which provided up to $12,000 in enhanced benefits. Previous analysis of these enhancements, called

Table 5 presents marginal recruiting costs and percentage standard errors for high-quality recruits computed from 1980 and 1981 recruiter elasticity estimates. The first column estimates are computed from the elasticities drawn from the whole sample under the assumption that recruiters are permitted to increase the number of low-quality recruits simultaneously. The additional cost in recruiter resources necessary to produce an additional high-quality enlistment was computed to be \$6,800 and \$10,300 using 1980 and 1981 total elasticity estimates, respectively. The next pair of computations are derived from elasticities estimated under the assumption that low-quality enlistments are held constant. Since none of the additional recruiter resources are expended in the enlistment of low-quality categories, the possible increase in high-quality enlistments is higher and the respective marginal cost estimates fall to \$4,800 and \$4,400.

Of course, we have seen that not all recruiting areas may be equivalently motivated to increase production in response to additional resource allocations. In particular, recruiter elasticities are greater for areas typically not meeting quotas. Thus, computed marginal recruiting costs, holding low quality constant, are \$3,600 and \$3,000 in these areas. Finally, it is possible, by applying the estimated tradeoff

Table 5

MARGINAL RECRUITING COSTS FOR HIGH-QUALITY ENLISTMENTS
(In $)

Year	A	B	C	D
1980	6,800 (18%)	4,800 (13%)	3,600 (12%)	2,900 (12%)
1981	10,300 (27%)	4,400 (14%)	3,000 (15%)	2,300 (15%)

NOTES: Col. A: whole sample, allows rise in low-quality enlistments. Col. B: whole sample, constant low-quality enlistments. Col. C: low achievers, constant low-quality enlistments. Col. D: low achievers, constant total enlistments.

Percentage standard errors are given in parentheses.

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